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<p>The problem outlined in the original proposal was broadly concerned with the elucidation of the electrical behavior of a system comprised of a non-metallic solid or liquid material, usually an electrolyte, between two electrodes. It proposed the development of new means of interpreting small-signal AC response of such systems (now called Impedance Spectroscopy) and included experimental and theoretical work on mixed (electronic and ionic) conductivity materials. In addition, it proposed a Monte Carlo simulation study of a monolayer of dipoles in an electric field.</p>				
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BRIEF OUTLINE OF RESEARCH FINDINGS

This is the final report on ARO Contract DAAG29-84-K-0132 which began on 8/15/84 and ended on 12/31/89. I want to begin by offering my sincerest thanks to ARO for supporting my research and those of my many associates over the period. ARO's support was, from my point of view, enlightened and expert. It made possible the many published papers cited on the several attached pages. In addition, Ph.D.'s in Chemistry were awarded to M.L. Inglehart and Junguo Zhao, working with Professor Richard Buck, the co-principal investigator. Both were partially supported by the present contract.

Other personnel besides the P.I., the co-P.I., and Drs. Inglehart and Zhao who worked part or full-time on the contract were:

Dr. Neal Sane, research associate
Mr. Larry D. Potter, Jr., undergraduate
Mr. Robert Hurt, undergraduate
Mr. Thomas Berube, graduate student in chemistry
Mr. M. Singh, research associate
Ms. Lori Lipkin, undergraduate
Mr. Gregory B. Cook, graduate student in physics

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During the last period, the P.I. wrote a long general article on Impedance Spectroscopy which is to be published in the 1991 Yearbook of the Academic Press Encyclopedia of Physical Sciences and Technology.

Publications of Dr. J. Ross Macdonald, P.I., and Collaborators
Supported by ARO Contract DAAG29-84-K-0132; 1984-1989

- "New Aspects of Some Small-Signal ac Frequency Response Functions," Solid State Ionics 15, 159-161, March (1985).
- "Comparison of Two Recent Approaches Towards a Unified Theory of the Electrical Double Layer," (with S.W. Kenkel), Electrochim. Acta 30, 823-826, June (1985).
- "Frequency Response of Unified Dielectric and Conductive Systems Involving an Exponential Distribution of Activation Energies," J. Appl. Phys. 58, 1955-1970, 1 September (1985).
- "Generalizations of 'Universal Dielectric Response' and a General Distribution-of-Activation-Energies Model for Dielectric and Conductive Systems," J. Appl. Phys. 58, 1971-1978, 1 September (1985).
- "Reply to Comments by Almond and West on Na β -Alumina Immittance Data Analysis," (with G.B. Cook), J. Electroanal. Chem. 193, 57-74, 1 October (1985).
- "Analysis of Dielectric or Conductive System Frequency Response Data Using the Williams-Watts Function," (with R. L. Hurt), J. Chem. Phys. 84, 496-502, 1 January (1986).
- "Some Simple Equivalent Circuits for Ionic Conductors," (with R. L. Hurt), J. Electroanal. Chem. 200, 69-82, 25 March (1986).
- "Distributed Circuit Elements in Impedance Spectroscopy: A Unified Treatment of Conductive and Dielectric Systems," (with R. L. Hurt), Solid State Ionics 20, 111-124, April (1986).
- "Relaxation in Systems with Exponential or Gaussian Distributions of Activation Energies," J. Appl. Phys. 61, 700-713, 15 January (1987).
- "Comparison and Discussion of Some Theories of the Equilibrium Double Layer in Liquid Electrolytes," J. Electroanal. Chem. 223 1-23, 25 May (1987).
- "Impedance Spectroscopy and its Use in Analyzing the Steady-State AC Response of Solid and Liquid Electrolytes," J. Electroanal. Chem. 223, 25-50, 25 May (1987).
- "Impedance Spectroscopy - Emphasizing Solid Materials and Systems, edited by J. R. Macdonald, who is also a contributor (John Wiley & Sons, New York, 1987).
- "A Flexible Procedure for Analyzing Impedance Spectroscopy Results: Description and Illustrations," (with Larry D. Potter, Jr.), Solid State Ionics 23, 61-79, June (1987).

ARO Supported Publications

of

Dr. Richard P. Buck

(Co-Principal Investigator)

R.P. Buck, "Diffusion-Migration Impedances for Finite, One-Dimensional Transport in Thin Layer and Membrane Cells, Part II: Mixed Conduction Cases:Os(III)/Os(II)C104 Polymer Membranes Including Steady State I-V Responses", J. Electroanal. Chem., 219 (1987), 23-48.

R.P. Buck, "Exchange Diffusion in One-Dimension: Liquid Electrolytes and Mixed Conductor Membranes", J. Electroanal. Chem., 243 (1988) 279-292.

R.P. Buck, "Electron Hopping in One-Dimension: Mixed Conductor Membranes", J. Phys. Chem., 92 (1988) 4196-4200.

Junguo Zhao and R.P. Buck, "The Influence of Contact Materials on Electric Properties of Single Crystal AgBr", J. Electrochem. Soc., 136 (1989) 3342-3351.